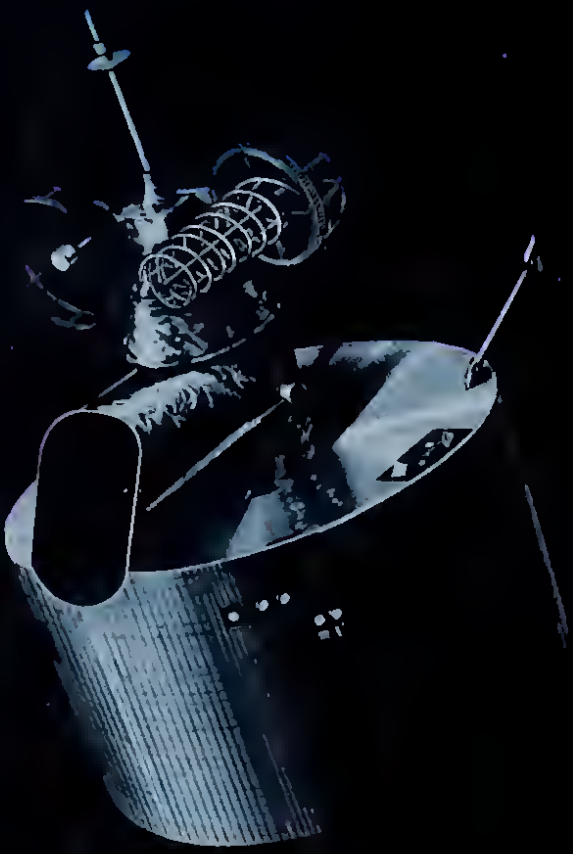
C55.502:G29/981

GOES

Geostationary Operational Environmental Satellite



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Earth Satellite Service

Some 35,800 kilometers into space the satellites seem to mark time above the earth's equator, their scanners watching the planetary disc almost continuously, their communication relays passing on data from automated surface sensors, their flow of data providing environmental scientists with one of the greatest gifts thus far received from space technology—the ability to watch large and middle-scale events in the atmosphere and ocean as they unfold.

They are GOES, Geostationary Operational Environmental Satellites, operational descendants of the Applications Technology Satellites developed by the National Aeronautics and Space Administration in the 1960's. GOES have evolved from ATS experience, and from day-to-day use of geostationary satellite data in detecting and forecasting severe local storms, hurricanes, the great air masses that fight along cloudy fronts.

These satellites are part of a series of spacecraft operated by the National Earth Satellite Service, part of the U.S. Commerce Department's National Oceanic and Atmospheric Administration. Other spacecraft—the TIROS-N series—occupy much lower, polar orbits, providing the other portion of satellite coverage that constitutes the national operational environmental satellite system.

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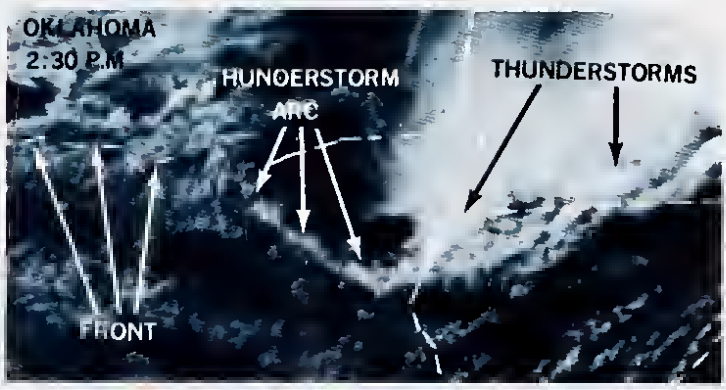
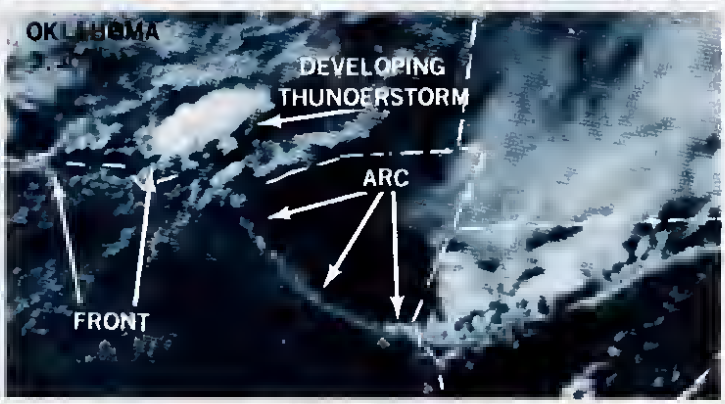
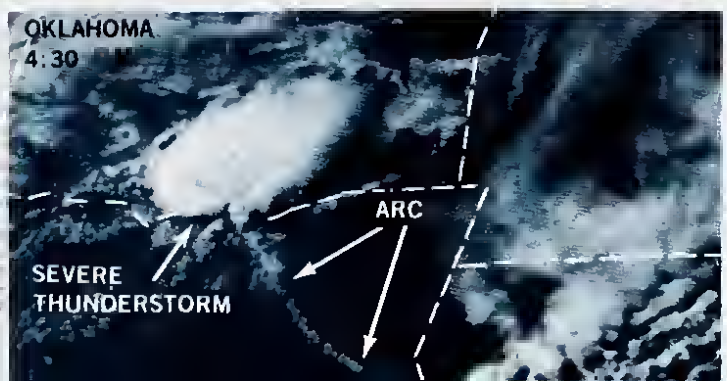
From positions over the equator GOES "see" all of North and South America and adjacent ocean areas with good resolution, and obtain and transmit data messages from any point on the earth within their view.

The satellites are spin-stabilized, with their spin axis parallel to the earth's axis, orbiting in the plane of the equator. The spin-scan radiometer can provide a full-disk view of the earth every half-hour, day and night, or partial view more often. Changes in the geomagnetic field and the flow of energetic material from the sun—electrons, protons, and X-radiation—are sensed by the space environment monitor. And each satellite is a high-flying data relay system, collecting raw information from river gages, buoys, ships, and other sensors for transmission to environmental centers on earth.

One kilometer resolution satellite imagery shows a rapidly developing severe weather situation. Severe thunderstorms are generated where the thunderstorm-produced arc line intersects a frontal boundary.







This flow of images and other forms of data is transformed by scientists and equipment on the ground into satellite photographs, weather maps, measurements of changes in the space environment, the time-lapse films we see on television weather shows, analyses of wind fields, cloud temperatures and interhemisphere mixing, and buoy-gathered data on the marine environment and its life.

But the geostationary satellite's most important contribution may be its ability to show, in virtual real time, destructive natural events at several scales of size and motion.

A developing local storm comes beneath a polar-orbiting satellite's scanners only once each 12 hours, and some events—the ones of such crucial importance to human safety—have formed, done their damage, and decayed long before that time has elapsed. Thus, the half-hourly or more frequent pictures from GOES have become a vital element in NOAA's national severe storm warning apparatus.

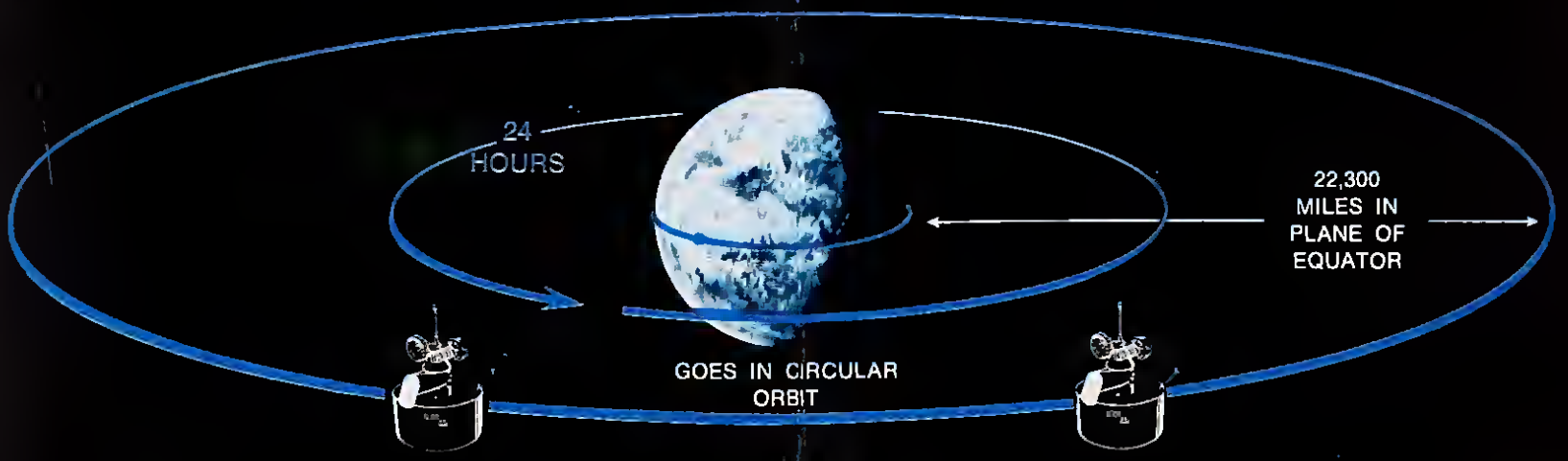
GOES have enhanced the warning systems developed for larger storms, particularly hurricanes and their larger, less violent extratropical cousins. The geostationary view permits better estimates of storm track, wind fields, temperatures, and, on the global scale, distribution of energy; revealing which weather systems are contributing to or drawing off the storm's energy, and what steering forces are at work.

Hydrologists use GOES-relayed data from automatic sensors on the ground and GOES-derived precipitation analyses in monitoring the potential for, and extent of, flooding; and, at NOAA's Environmental Research Laboratories, space environmental data collected by GOES are used to prepare warnings of potentially disruptive or hazardous increases in solar activity.

Increasingly, information from GOES spacecraft is being applied in the areas of commercial fishing, marine transportation, agriculture, water resource management, and numerous other activities effecting society as a whole. The potential of these versatile satellites is just being realized.

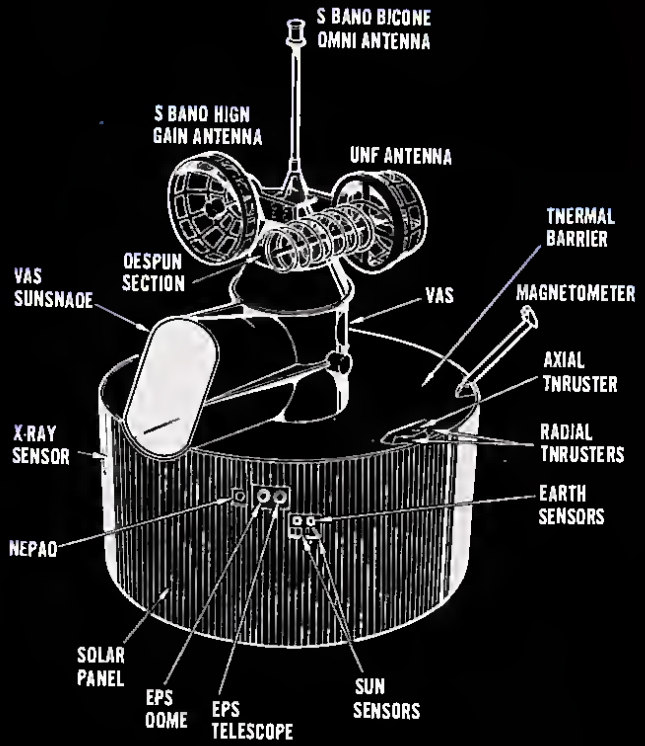
In order to speed GOES data to National Weather Service offices at the local and regional levels—where forecasters must deal with such "short-fused" weather occurrences as thunderstorms and tornadoes—the National Earth Satellite Service field organization includes seven Satellite Field Services Stations. These stations are mainly concerned with receiving, processing, interpreting, and disseminating GOES data. They are located adjacent to the following National Weather Service facilities: the National Severe Storms Forecast Center in Kansas City, Mo.; the National Hurricane Center in Miami, Fla.; and the Weather Service Forecast Offices in San Francisco, Calif.; Honolulu, Hawaii, Washington, D.C., Anchorage, Alaska, and New Orleans, La.

GEOSTATIONARY (OR SYNCHRONOUS) ORBIT



An object injected at sufficient speed, in the right direction, can be orbited at any altitude above the atmosphere; however, as the distance between satellite and planet increases, the speed required to maintain an orbit decreases. At an altitude of about 35,800 km, the orbital speed is down to about 11,000 km per hour, and the period of the circular orbit becomes 24 hours. If this 35,800-km-high orbit lies in the plane of the earth's equator, the satellite and earth turn through the same arc distance in the same time, so that the satellite is always above the same point on the equator—that is, the satellite is geostationary.

Two GOES spacecraft, in geostationary orbit over the equatorial Atlantic and Pacific, provide coverage of a large portion of the Western Hemisphere.



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NOAA and its National Earth Satellite Service are working at the threshold of our ability to observe the environment from space. NESS operates the Nation's civil operational environmental satellite system and is developing new ways of using this system and its massive output of environmental data for the general benefit. In addition, NESS has been given responsibility for managing the Landsat system and planning for the commercialization of civil operational land remote sensing from space.

NESS headquarters are in Federal Office Building 4, Suitland, Md. The Command and Data Acquisition station for GOES is located at Wallops Station, Va. Selected National Weather Service offices have been equipped to receive and handle GOES imagery relayed to them through the NESS Central Data Distribution Facility and Satellite Field Services Stations.

Other Federal agencies, educational institutions, numerous television stations, and others receive imagery in varying quantities by tapping into the SFSS's or appropriate National Weather Service facilities.

As the earth's atmosphere recognizes no political boundaries, all nations may benefit from cooperative efforts in meteorology, such as international weather message codes, exchange of data, and others. In support of this, NOAA's National Earth Satellite Service is a major element in the United State's World Meteorological Center, in Washington, D.C., as are NOAA's National Meteorological Center and its Environmental Data and Information Service. This is one of three world data centers established under the United Nations' World Meteorological Organization. The others are in Moscow and Melborne.

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